

CLAIMS

1.(amended) A field emission type electron source device comprising:

a field emission electron source portion including an extraction electrode provided on a p-type silicon substrate via an insulating film and having an opening portion at a position corresponding to a region where a cathode is provided; and a cathode portion provided on the p-type silicon substrate and at a position corresponding to the opening portion of the extraction electrode; and

an n-channel field effect transistor portion provided on the p-type silicon substrate, corresponding to the field emission electron source portion,

wherein:

the field emission electron source portion is provided in a drain region of the field effect transistor portion; and a control voltage is applied to a gate electrode of the field effect transistor portion to control a field emission current from the field emission electron source portion;

the drain region includes different impurity elements and includes at least two wells having different impurity concentrations having symmetrical impurity distributions; and

of the at least two wells, one well having a low impurity concentration is provided at an end of the drain region which contacts a channel region of the field effect transistor portion.

2. A field emission type electron source device according to claim 1, wherein as the impurity elements the drain region includes at least two n-type impurity elements having

different thermal diffusion speeds in the silicon substrate.

3. A field emission type electron source device according to claim 1, wherein as the impurity elements, the drain region includes phosphorous, having a fast thermal diffusion speed and arsenic, having a slow thermal diffusion speed in the silicon substrate.